

NOTES ON *HERPOSIPHONIA* (RHOOCELACEAE,
RHOOPHYTA) IN SOUTH AFRICA,
WITH A DESCRIPTION OF A NEW SPECIES

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ABSTRACT. — Observations are made on four species of *Herposiphonia* Naegeli based on recent collections made in South Africa. *Herposiphonia prorepens* (Harv.) Schm. in Engler, *H. insidiosa* (Grev. in J. Ag.) Falkenb., and *H. secunda* f. *tenella* (C. Ag.) comb. nov. have previously been recorded from South Africa, whereas *H. clavata* sp. nov. is newly described. The latter species seems to be related to *H. colombiana* Schnetter & Bula Meyer in having the suprabasal segment of the determinate branches relatively much longer than the other segments in the branch. But these species can be separated by the incurved, clavate shape of the determinate branches in the new species.

RÉSUMÉ. — Quatre espèces d'*Herposiphonia* Naegeli, récemment récoltées en Afrique du Sud, ont été examinées : *H. prorepens* (Harv.) Schm. in Engler, *H. insidiosa* (Grev. in J. Ag.) Falkenb. et *H. secunda* f. *tenella* (C. Ag.) comb. nov., déjà connues d'Afrique du Sud ; *H. clavata* sp. nov., espèce nouvelle pour la science. Cette dernière espèce semble pouvoir être rapprochée de *H. colombiana* Schnetter et Bula Meyer car, comme chez celle-ci, dans les rameaux à croissance définie, le segment suprabasal est nettement plus long que les autres segments ; cependant, elle s'en distingue par ses rameaux à croissance définie incurvés et claviformes.

KEY-WORDS : *Herposiphonia*, *Herposiphonia clavata* sp. nov., marine algae, Rhodomelaceae, Rhodophyta, South Africa.

INTRODUCTION

Up to now seven species of the genus *Herposiphonia* Naegeli have been recorded from South Africa (SEAGRIEF, 1984) : *H. ceratoclada* (Mont.) Falkenb., *H. falcata* (Kütz.) De Toni, *H. heringii* (Harv.) Falkenb., *H. insidiosa* (Grev. in J. Ag.) Falkenb., *H. prorepens* (Harv.) Schm. in Engler, and *H. subdisticha* Okam. Seagrif's list also included SAENGER's (1973) record of *H. tenella* (C. Ag.) Ambronn from nearby Inhaca Island in Moçambique, which is a species known from warm temperate and tropical seas throughout the world.

Herposiphonia heringii and *H. prorepens* were described by HARVEY (1847) on the basis of South African collections, the former on Krauss material from Durban and the latter on Bowerbank material from Algoa Bay. Both species have been reported again from South Africa (WEBER VAN BOSSE, 1923 ; KYLIN, 1938). *Herposiphonia falcata* was described by KÜTZING (1863) on the basis of a Pappe collection from the Cape of Good Hope; it was an epiphyte on Gym-

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nogongrus complicatus (Kütz.) Papenf. *Herposiphonia insidiosa* was first described from the East Indies (J. AGARDH, 1863), and *H. subdisticha* was described from Japan (OKAMURA, 1999).

The record by SEAGRIEF (1984) of *H. ceratoclada* from South Africa is questionable. This species has been stated to have a Subantarctic distribution (PAPENFUSS, 1964; SANTELICES and ABBOTT, 1978). But more pertinent is the communication to me from F. ARDRÉ (*in litt.*, 1984) that the type specimen (Herb. Montagne in PC: « Polysiphonia ceratoclada Montag. ad Ulvam, Auckland, M. Hombron ») is almost certainly not a *Herposiphonia* and that FALKENBERG's (1901) figures do not correspond to the type. It is also worth noting that DE TONI (1903) referred to the sketch in Montagne's *Voy. Pol. Sud.* in this way: « Pl. V. fig. 2 (non bona) ? ». Obviously, the very nature of this alga that has been called *H. ceratoclada* (Mont.) Falkenb. needs clarification, and it seems appropriate to disregard the record of this species from South Africa.

MATERIALS AND METHODS

Collections were both preserved in 5 % formalin/sea water or preserved as herbarium specimens. For microscopic observations specimens were mounted in a mixture of 30 % liquid glucose (Karo Syrup) to which had been added a few drops of 1 % aniline blue and a few drops of 1 N HCl. Photographs were taken with a camera-back on a Zeiss research microscope. All of the specimens cited in this paper have been deposited in the Herbarium of the University of Michigan, Ann Arbor (= MICH).

OBSERVATIONS

HERPOSIPHONIA CLAVATA sp. nov. (Fig. 1-5)

Axes indeterminati prostati, 3-4 mm long. super substratum, ramosi, 80-115 µm diam., 8-9 cellulae pericentrales omni in segmento, hae e quasi omni segmento ramum determinatum aut indeterminatum (aut ramum primordium) in serie e 3 ramis determinatis deinde uno ramo determinato constituta efficiunt; segmenta axorum repentium ratiorem longitudinis et latitudines 1:1 habentia; rhizoidea unicellularia e segmentis axium repentium singulatim effecta, pulvinos affixionis digitatos cum substrato formantia; rami determinati erecti, simplices, clavati, ad apicem axis prostrati versus incurvati; 250-410 (-600) µm alt. et e 10-14 segmentis plerumque constituti; segmentum basale rami determinati 4 cellulas pericentrales habens, segmentum suprabasalem 7 cellulas pericentrales, et segmenta regione in media 10-12 cellulas pericentrales habens; regio media rami determinati 90-130 µm lat.; cellulae axiales rami determinati magnae, 50-54 µm diam.; segmentum suprabasale rami determinati multo longius quam

alia omnia segmenta, usque ad 130 µm long. ; alia segmenta latiora quam longa; trichoblasti nulli nisi cum procarpi consociati; procarpi subapicales, in segmento quarto ad sexto ab apice plerumque siti.

Holotypus : legit M. WYNNE 7318 in MICH; 16.iii.1983, Mdloti Beach, Natal Prov., South Africa; female/cystocarpic.

HERPOSIPHONIA CLAVATA sp. nov. (Fig. 1-5)

Indeterminate axes prostrate, 3-4 mm long over substratum, branching, 80-115 µm diam., with 8-9 pericentral cells per segment, giving rise from almost every segment to a determinate branch or an indeterminate branch (or branch primordium), in a sequence of 3 determinate branches followed by one indeterminate branch; segments of creeping axis with a length : width ratio 1:1; unicellular rhizoids produced singly from segments of creeping axes, forming distal digitate attachment pads with substratum; determinate branches erect, simple, clavate, incurved toward apex of prostrate axis, 250-410 (-600) µm high and consisting of usually 10-14 segments; basal segment of determinate branch with 4 pericentral cells, suprabasal segment with 7 pericentral cells, and segments in midregion with 10-12 pericentral cells; midregion of determinate branch 90-130 µm broad; axial cells of determinate branch large, 50-54 µm diam.; suprabasal segment of determinate branch much longer than any other segment, to 130 µm long; other segments broader than long; trichoblasts absent, except in association with procarps; procarps subapical, usually on 4th to 6th segment from the apex (Fig. 4 and 5).

Holotype : collected by M. WYNNE 7318, 16.iii.1983; Mdloti Beach, north of Durban, Natal Prov., S. Africa; female/cystocarpic; epiphytic on *Amphiroa bowerbankii* Harv. Deposited in MICH.

Isotypes : deposited in NU and US.

Additional collection : WYNNE 6839, 22.i.1983; Arniston, Cape Prov.; sterile; epiphytic on *Champia*.

These very small thalli (Fig. 1 and 2), extending only 3 to 4 mm over the substratum, are similar in overall appearance to *H. prorepens* and *H. fusca* Jaasund (JAASUND, 1977), the latter species described from Tanzania. The new species can be distinguished from *H. prorepens* by the greater number of segments in the determinate branches in *H. prorepens*, namely, 18 to 25, and the absence of a much elongated suprabasal cell in determinate branches of *H. prorepens*. It is to be pointed out that a collection made at Arniston contained both *H. clavata* and *H. prorepens* co-occurring on the same host. But there was no problem in seeing the differences. The new species agrees with

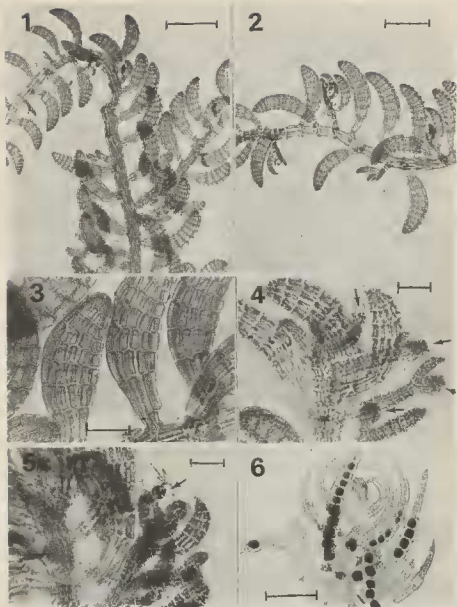


Fig. 1-6. — Fig. 1-5. *Herposiphonia clavata*. Fig. 6. *Herposiphonia insidiosa*. Fig. 1 and 2. Creeping indeterminate axes bearing clavate determinate laterals and potential indeterminate branches in a 3:1 sequence. Fig. 3. Individual determinate laterals with the distinctly elongate suprabasal segment. Fig. 4 and 5. Female plants bearing subapical procarpia (arrow). Fig. 6. Tetrasporic plant with determinate laterals curving over the apex of the axis. Scale bars : 200 μm in Fig. 1, 2, and 6; 50 μm in Fig. 3-5.



H. fusca in the general height range and number of segments in the determinate branches. This latter species, however, also lacks the distinctive suprabasal cell in determinate branches that is so characteristic of *H. clavata* (Fig. 3).

On the basis of the unusual suprabasal segment this species is distinguishable from all other species of the genus except for the recently described *H. colombiana* (SCHNETTER and BULA MEYER, 1982). In addition to the description and figures provided by SCHNETTER and BULA MEYER (1982), these authors provided me with photographs of their alga to assist in making a comparison. Their species has only 5 pericentral cells per segment in the prostrate axes and 7 pericentral cells per segment in the erect (determinate) branches. Furthermore, the determinate branches are longer (to 1 mm vs. 0.6 mm in the new species), consisting of 15 segments rather than the approximate 13 segments in *H. clavata*. Also, the determinate branches in *H. colombiana* are linear; those of *H. clavata* are clavate (Fig. 3). Another difference is that the main axes in *H. colombiana* have many segments without branches, whereas in the new species there is a regular production of branches essentially from every segment of a creeping axis (Fig. 1 and 2).

The new species bears some resemblance to *Herposiphonia guineensis* of western Africa (LAWSON and JOHN, 1982). That species also has clavate determinate branches arching distally (their pl. 54, fig. 2), with 9-10 pericentral cells per segment in the branches. But it is a much more robust alga, the axes becoming secondarily erect and reaching 4 cm in height, and it bears trichoblasts. Also, its suprabasal segments are apparently not different from the other segments in the determinate branches.

HERPOSIPHONIA INSIDIOSA (Grev. in J. Ag.) Falkenb. (Fig. 6)

Collection : WYNNE 6468-A, 31.xii.1982; Rocky Bay, Park Rynle, south of Durban, Natal Prov.; tetrasporic; epiphytic on articulated coralline alga.

In addition to its original record from the East Indies (J. AGARDH, 1863), this species has been reported from Japan (OKAMURA, 1930), India (BØRGESEN, 1937), Hong Kong (TSENG, 1944), Viet Nam (DAWSON, 1954), and Tanzania (JAASUND, 1977). This species has been depicted as having the indeterminate branches arise in an irregular pattern (OKAMURA, 1930; BØRGESEN, 1937). OKAMURA (1930) referred to the « very closely branched » habit, resulting in « a thickly entangled mass ». The present material showed congested growing regions, the short shoots (i.e., determinate branches) curving over the apices (Fig. 6). This is in agreement with JAASUND's (1976) illustration.

The number of segments in a determinate branch has been stated to be 20-26, up to 25, 25-26, or 30 by TSENG (1944), JAASUND (1977), OKAMURA (1930), and BØRGESEN (1937), respectively. The South African sample has up to 22 segments per determinate branch. Pericentral cell number is 10 to 12 per segment, also in agreement with other reports for this species. One or two trichoblasts terminate the apices of some of the determinate branches.

HERPOSIPHONIA PROREPENS (Harv.) Schm. in Engler (Fig. 7-10)

Collections : WYNNE 6839-A, 22.i.1983; Arniston, Cape Prov.; tetrasporic; epiphytic on *Champia* sp. WYNNE 6927, 14.ii.1983; Mdloti Beach, north of Durban, Natal Prov.; epiphytic on *Caulerpa filiformis* (Suhr) Hering. WYNNE 7145 (collected by R. Pienaar), 27.ii.1983; Rocky Bay, Park Rynie, south of Durban, Natal Prov.; male; epiphytic on *Halimeda cuneata* Hering in Krauss. WYNNE 7244, 1.iii.1983; Umdoni Point, south of Durban, Natal Prov.; male; epiphytic on *Cladophora rugulosa* Martens. WYNNE 7264, 16.iii.1983; Mdloti Beach, north of Durban, Natal Prov.; tetrasporic & cystocarpic.

This species was first described by HARVEY (1847), but confusion was later created when HARVEY (1862) erred in assuming that his collections from Australia were identical with the South African species. Thus, his pl. 185 B, (HARVEY, 1862) represented a heterogeneous mixture of collections and taxa, as FALKENBERG (1901) has explained. Some of the Australian material was *Dipterosiphonia* (pl. 185 B, fig. 1); other material was *Herposiphonia* (pl. 185 B, figs. 2-5). But as will be explained below, it does not seem to be *H. prorepens* in that the location of the procarps in Harvey's figure does not agree with the present observations of South African material identified as *H. prorepens*. It is believed that HARVEY (1862) did not have genuine *H. prorepens* in his Australian-based account.

HARVEY's (1847) original account referred to an alga consisting of creeping axes producing simple, erect, falcate determinate branches about 2 mm tall. The creeping axes had about 12 pericentral cells per segment. The tetrasporangia were arranged in a single row. The recent collections are consistent with previous accounts for this species in South Africa. WEBER VAN BOSSE (1923) reported 8-12 pericentral cells and determinate branches having up to 20 segments. In examining the many collections cited, I have found determinate branches to have usually 18 to 20 segments (Fig. 7 and 8), but a range of 16 to 25 segments was observed. Spermatangial stichidia (WYNNE 7145, WYNNE 7244) were present in a straight row (Fig. 9) on determinate branches; the entire trichoblast was converted into the spermatangial cluster.

In the single collection containing female plants (WYNNE 7264), solitary procarps or cystocarps were located on the 4th or 5th segment from the base of determinate branches (Fig. 10). This observation is not consistent with HARVEY's (1862) figure of subapical procarps for this species. But as has been pointed out above, HARVEY's 1862 account of this species in Australia was confused by his having a mixture of plants. The concept of the species should be restricted to his original 1847 description of it as an alga occurring in South Africa. The 1862 account of it as also present in Australia should be discounted (See also FALKENBERG, 1901).

It is noteworthy that *Herposiphonia falcata* (Kütz.). De Toni is similar to *H. prorepens* in having very small thalli with falcate determinate branches. From KÜTZING's (1863) figure it appears that there are 8 or more pericentral

cells per segment. Apices are obtuse, however, rather than acute as in *H. prorepens*. Trichoblasts are apparently absent in *H. falcata*. They were occasionally observed in *H. prorepens*. The relationship between these two similar species requires further clarification.

HERPOSIPHONIA SECUNDA (C. Ag.) Ambronn f. *tenella* (C. Ag.) comb. nov.

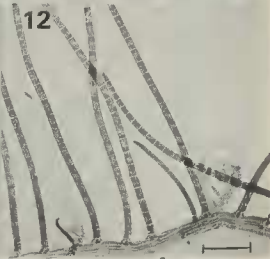
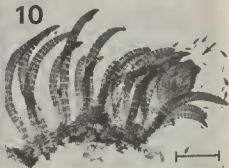
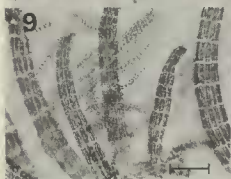
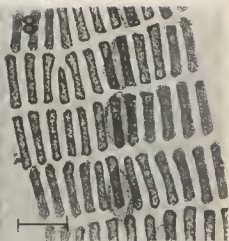
Basionym: *Hutchinsia tenella* C. Agardh, 1828, p. 105.

Collections: WYNNE 6579, 31.xii.1982; Rocky Bay, Park Rynie, south of Durban, Natal Prov.; epiphytic on *Valonia macrophysa* Kütz. WYNNE 6654, 18.i.1983; Skoenmakerskop, Cape Recife, Cape Prov.; epiphytic on *Laurencia* sp. WYNNE 7050, 27.i.1983; Haga Haga, Cape Prov.; on mussels.

Characteristics of this form of this widespread species include the regular production of branches from almost every segment of the indeterminate axes, the non-congested appearance of the branches (Fig. 11 and 12), the determinate branches consisting of up to 50 segments, and their height of up to 5 mm. There is apparently some variation possible in the number of pericentral cells. HOLLENBERG (1968) stated that there are 8-9 pericentral cells in segments of determinate branches, whereas JAASUND (1976) reported 12 to 16. The present material has 10-12 pericentral cells in segments of determinate branches, which were up to 3 mm long and consisted of typically 28 to 34 segments (Fig. 12). The creeping axes were 100-165 μ m in diameter.

The relationship between *Herposiphonia tenella* (C. Ag.) Ambronn, which is recognized to be the lectotype of the genus (FARR et al., 1979), and *H. secunda* (C. Ag.) Ambronn has been debatable. BØRGESSEN (1918) initially expressed the view that *H. secunda* was most likely merely a reduced form or variety of *H. tenella*; later, however, BØRGESSEN (1920) changed his mind, distinguishing these taxa as separate species on the basis of alleged differences in the male plants.

Traditionally, differences in modes of branching have served as the primary criterion in recognizing these two taxa as distinct. HOLLENBERG (1968), however, observed that different branching patterns could occur on single plants, which fact had earlier been pointed out by FALKENBERG (1901) and BØRGESSEN (1918). Hollenberg thus concluded that *H. tenella* and *H. secunda* could not be distinguished at the species level and opted to regard them as forms of a single species, which he designated as *H. tenella*. This taxonomic approach has been accepted by most subsequent workers (ABBOTT and HOLLENBERG, 1976; LAWSON and JOHN, 1977, 1982; NGAN and PRICE, 1979; SEARLES and SCHNEIDER, 1978; KAPRAUN, 1980; MEÑEZ and MATHIESON, 1981; SCHNETTER and BULA MEYER, 1982; CRIBB, 1983; and LEWIS, 1984), although some workers have continued to recognize



the two as separate species (ARDRE, 1970; NIZAMUDDIN et al., 1979; NORRIS and BUCHER, 1982).

Since *Herposiphonia tenella* is the lectotype of the genus, it would appear that HOLLENBERG (1968) automatically assumed that *H. secunda* should be relegated to the sub-specific category (his forma *secunda*). *Hutchinsia secunda* (C. AGARDH, 1824), however, holds priority over *Hutchinsia tenella* (C. AGARDH, 1828). Therefore, the correct name for this species should be *Herposiphonia secunda*, with *tenella* being treated as the forma (or other infraspecific rank). Thus, the new combination as proposed above is called for. Also, accepting LAWSON and JOHN's (1982) taxonomic judgement that *H. densa* Pilger falls into a subspecific rank, the following transfer is proposed :

HERPOSIPHONIA SECUNDA (C. Ag.) Ambronn forma *densa* (Pilger) comb. nov.

Basionym : *Herposiphonia densa* Pilger, 1911, p. 307. fig. 16, 17.

HOLLENBERG (1968, p. 556) stated that he was able to examine a specimen in the Agardhian Herbarium in Lund that was regarded as the isotype of *Hutchinsia secunda*, namely, No. 39158 and collected « Aug. 6, 1825, Tingi, Schousboe ». If indeed this is the correct date of collection, it cannot be an isotype in that C. Agardh published his description in the previous year.

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Fig. 7-12.— Fig. 7-10 *Herposiphonia prorepens*. Fig. 11 and 12. *Herposiphonia secunda* f. *tenella*. Fig. 7. Characteristic plant with determinate laterals arising from indeterminate creeping axes. Fig. 8. Squashed determinate lateral revealing the (11 or 12) pericentral cells associated with each larger axial cell. Fig. 9. Male plant with spermatangial branches arranged in a straight row. Fig. 10. Female plant bearing a mature cystocarp (arrow) and released carpospores. Fig. 11 and 12. Creeping axes bearing determinate laterals or primordium of indeterminate branch from nearly every segment. Scale bars : 100 μm in Fig. 7; 50 μm in Fig. 8 and 9; 200 μm in Fig. 10-12.

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